

**REMARKS**

In the present Amendment, claim 1 is amended to further clearly point out the claimed subject matter, to recite that the substrate has, on its surface, non-periodically distributed scratches having an average depth of 0.01 to 5  $\mu\text{m}$ . Support is found, for example, at page 9, lines 22-24 of the specification, describing that the grooves are scratches formed on a surface of the substrate when the substrate is cut out of the ingot.

Withdrawn method claims 16 and 17 have been amended to include all of the limitations of amended product claim 1. If claim 1 is found to be allowable, Applicants respectfully request rejoinder of claims 16 and 17 pursuant to MPEP § 821.04.

No new matter has been added. Entry of the Amendment is respectfully requested as placing this application in condition for allowance.

**I. Drawings**

The Office Action Summary indicates that the drawings filed on July 19, 2006 are accepted.

In the previous Office Action dated June 8, 2009, the Examiner objected to the drawings filed on July 19, 2006 as not showing every feature of the invention specified in the claims. In response, a new drawing sheet (Figure 7) was submitted on September 8, 2009 together with an Amendment under 37 C.F.R. § 1.111.

The undersigned believes that the Examiner intended to approve all the drawings including the new drawing (Figure 7) filed September 8, 2009. Clarification and confirmation that the new drawing (Figure 7) is accepted is respectfully requested.

## **II. Claim Rejections under 35 U.S.C. § 103 Based on Sunakawa**

Claims 1, 2, 3, 5-10, 13-15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sunakawa et al. (US 2003/0207125; “Sunakawa”) in view of Ishida (US 6,864,158; “Ishida”).

Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Sunakawa in view of Cuomo et al (US 2002/0078881; “Cuomo”).

Claims 11 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Sunakawa in view of Uemura et al (US 6,917,059; “Uemura”).

The above rejections should be withdrawn because Sunakawa in view of Ishida, and/or other cited references, does not disclose or render obvious the presently claimed Group III nitride semiconductor multilayer structure, for at least the following reasons.

Claim 1 is directed to a Group III nitride semiconductor multilayer structure comprising a substrate; an  $\text{Al}_x\text{Ga}_{1-x}\text{N}$  ( $0 \leq x \leq 1$ ) buffer layer which is provided on the substrate and has a columnar or island-like crystal structure; and an  $\text{Al}_x\text{In}_y\text{Ga}_{1-x-y}\text{N}$  ( $0 \leq x \leq 1$ ,  $0 \leq y \leq 1$ ,  $0 \leq x + y \leq 1$ ) single-crystal layer provided on the buffer layer, wherein the substrate has, on its surface, non-periodically distributed scratches having an average depth of 0.01 to 5  $\mu\text{m}$ .

(1) In response to Applicants’ argument that Sunakawa does not recognize the average depth of the groove is a result-effective variable, the Examiner took the position that although Sunakawa is silent about the groove depth, paragraph [0107] of Sunakawa discloses that groove 14 is formed during Phosphoric acid and Sulfuric acid etch (1:1 volume ratio) of GaN layer 12 since the acid ratio also etches sapphire substrate 11. The Examiner asserted, as can be seen from Fig. 1 of Sunakawa, that the grooves 14 have some (different) depths.

According to the Examiner, in Fig. 1 of Sunakawa, the depths of the grooves 14 are not identical, i.e., the rightmost groove is shallower than the leftmost groove.

As such, the Examiner asserted that Sunakawa's grooves having depths with unknown range. The Examiner took the position that since Sunakawa's grooves having some depths with unknown range, it is reasonable to consider that the average depth (or depths) of the groove is a result-effective variable. See Office Action, at page 17, lines 6-8.

Applicants respectfully disagree.

MPEP 2144.05 states that only result-effective variables can be optimized. A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). In the present case, there is no disclosure or teaching anywhere in Sunakawa to the effect that the average depth of the groove (or scratch for that matter) would achieve any recognized result.

Contrary to the Examiner's assertion, Sunakawa does not recognize the average depth of the groove is a result-effective variable.

(2) In the Amendment filed September 8, 2009, Applicants' further pointed out that Ishida is not properly combinable with Sunakawa, because in Ishida, the grooves 11a having a depth of 0.1  $\mu\text{m}$  are formed by RIE (dry) etching, different from the wet etching employed by Sunakawa. The use of the dry etching technique of Ishida in place of the wet etching technique of Sunakawa would render Sunakawa unsuitable for its intended purpose.

In response, the Examiner took the position that Ishida was cited as a secondary reference to show the depths (average) of the groove, which, in the Examiner's view, does not depend on

whether the groove was formed by wet etching or RIE etching. The Examiner took the position that since the present claim 1 is a product claim not a process claim, the manner in which the depth of the groove is formed is irrelevant. Applicants disagree.

MPEP 2144.05 states that the proposed modification cannot render the prior art unsatisfactory for its intended purpose. If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)

In the present case, there is no suggestion or motivation to combine Ishida with Sunakawa because, the use of the dry etching technique of Ishida in place of the wet etching technique of Sunakawa would render Sunakawa unsuitable for its intended purpose.

Specifically, paragraph [0075] of Sunakawa describes that the buffer layer is generally formed of fine crystal grains, and that the insular crystal composed of the fine crystal grains is formed by wet etching. By wet etching, crystal grain boundaries are etched selectively and an isolated crystal grain portion is left. On the other hand, in the dry etching disclosed in Ishida, because the whole buffer layer is etched uniformly, the whole buffer layer thins and an isolated portion is not formed. In addition, Sunakawa discloses at paragraph [0041] that since a striped pattern needs to be formed, a lithography process including dry etching must be carried out. Sunakawa discloses that in dry etching, when an etching mask pattern is not formed, a groove cannot be formed.

Therefore, Sunakawa is not properly combinable with Ishida in the manner suggested by the Examiner.

(3) Claim 1 presently recites that the substrate has, on its surface, non-periodically distributed scratches having an average depth of 0.01 to 5  $\mu\text{m}$ .

According to the present application, when a substrate is cut out of an ingot, scratches formed on a surface of the substrate have a striped pattern.

In contrast, in Sunakawa, the GaN film 12 having an island shape and the groove 14 are formed by etching (see paragraph [0017] and FIG. 1 of Sunakawa). Since the groove 14 is between two adjacent GaN film 12 having an island shape, the groove 14 has a meshed pattern. Accordingly, the scratches recited in the amended claim 1 are structurally different from the grooves disclosed by Sunakawa.

(4) Cuomo was cited as disclosing a buffer layer with columnar crystal grains.

Uemura was cited as disclosing a Group III nitride semiconductor light-emitting device comprising a Group III nitride semiconductor multilayer structure.

Cuomo and Uemura do not make up the noted deficiencies of Sunakawa.

### **Conclusion**

In view of the above, it is respectfully submitted that the claims 1-15 are patentable over Sunakawa in view of Ishida, Cuomo and/or Uemura. Withdrawal of the foregoing rejections under 35 U.S.C. §103(a), rejoinder of withdrawn method claims 16 and 17 and allowance of claims 1-17 is respectfully requested.

Reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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